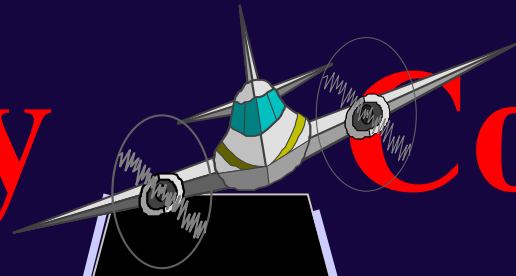


Runway



Collision

**Risk
Analysis**

**Arnold Barnett,
MIT**

FAA Wanted to Know :

Absent changes in technology and/or procedures, how great is the danger posed by *fatal runway collisions* at US airports over the next two decades?

Clearly, one wants to start with some historical data analysis, but *which data* should be used?

Should Tenerife count?

COE Viewpoint:

In assessing *probabilities* about future domestic runway collisions, it is appropriate to restrict attention to the *US historical record*.

However:

In estimating the *consequences* of a runway collision given that it occurs, it is appropriate to use data about *full worldwide experience*.

Mortality Rates in the Three Fatal **Jet-to-Jet** Runway Collisions Since 1970

Location:

Percent Killed:

	<u>First Jet</u>	<u>Second Jet</u>	<u>Both Jets Combined</u>
Tenerife	100(%)	76	88
Madrid	100	55	69
Detroit	21	0	4

Using all three collisions rather than just Detroit makes *a big difference*.

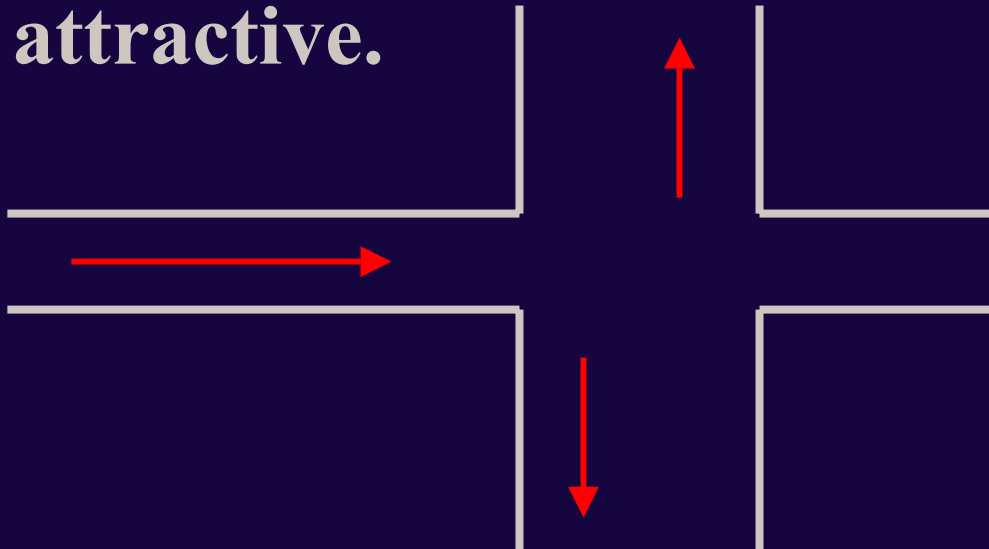
Another Issue:

To a **first approximation**, one might expect that a given airport's risk of a fatal runway collision would vary with the **square** of the annual number of operations.

Why?

1) The number of flights that could theoretically collide is $(N^2 - N)/2$, where $N = \text{number of operations}$.

2) The Quadratic Model is conceptually attractive.



But, to the extent possible,
it is desirable to go beyond merely
stating conjectures, and to test
hypotheses and “approximations”
against **empirical evidence**.

If the quadratic (N^2) hypothesis were true, then airports with 500,000 operations per year would, on a per capita basis, suffer about **four times** the annual risk of a fatal runway collision as airports with 250,000 operations per year.

(Right?)

We got access to data about the US airports at which **runway collisions and harrowing near misses** had occurred in recent years.

*The N^2 -hypothesis passed a statistical test **with flying colors**.*

Most interestingly, the hypotheses that dangerous events varied across airports with either N (*linear model*) or N^3 (*cubic model*) *did not pass* statistical tests.

The full study (ATCQ, 2000)
estimated that:

Overall, US runway collisions over
the period 2003-2022 could cause
700-800 deaths and **200** serious
injuries.

(Mid-range figure)

Given this projection:

Runway collisions could
cause more US domestic jet
deaths over the next two
decades than **all other
accidents combined.**

Concerned by these projections, FAA determined that *25 mid-sized airports* should receive new state-of-the-art ground radars.

It described this outcome as a “**joint FAA/MIT decision.**”

What Now?